LEVERAGE AND THE TAKEOVER MARKET

By

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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

1993

To my wife, Connie.

ACKNOWLEDGEMENTS

I thank my committee, especially Mark Flannery (chairman), Mike Ryngaert, and Dave Brown, for their time, patience, and insight. I thank Vinay Datar, Jon Garfinkel, and Eddie O'Neal for helpful discussions and comments. I also thank Baker Duncan for his friendship and guidance. I especially thank my parents, Audrey and David Walker, for their endless encouragement and support.

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December 1993

Chairman: Mark J. Flannery
Major Department: Finance, Insurance, and Real Estate

Society benefits from all acquisitions in which value is created (i.e. when the value of the merged entity is greater than the sum of the pre-merged values of the two individual firms). However, socially optimal mergers are not guaranteed to occur. The decision to merge is made by the equityholders of the two firms, and therefore depends solely on their share of the merger gains which are net of any gains to target debtholders. As the potential target debtholder gain increases (decreases), the likelihood of that target being involved in a successful merger decreases (increases). This dissertation empirically investigates the relationship between a firm's capital structure and its takeover likelihood using a sample of 3,351 NYSE or AMEX traded firms from 1977 through

1989. I find that as the potential gain of a firm's debt increases the takeover likelihood of that firm decreases.

Target firm equityholders generally experience significant abnormal positive returns. Presumably the bidder pays the target some percentage premium above the pre-merger value of the target's assets (regardless of the target's financing of those assets). Taken alone, this implies that the target equity abnormal return should increase in leverage. However, the acquisition premium may partially accrue to target debtholders in the form of wealth transfers due to coinsurance. Previous studies ignore the role of leverage in determining the target equityholders abnormal return. I find that the target equity abnormal return significantly increases in the target firm's leverage for a sample of 135 cash tender offers from 1980 through 1988. Further, the results suggest debtholder gains are small relative to the acquisition premium.

CHAPTER 1

INTRODUCTION

In a perfect economy wealth is maximized. This implies that all takeovers which result in the creation of wealth occur. Therefore the socially optimal decision criterion for merging two firms is whether or not the merger results in an entity whose value is greater than the sum of the pre-merger values of the two participating firms. However, a firm's capital structure may alter the decision criterion such that the social optimum is no longer guaranteed.

The management of a bidding firm decides to attempt a takeover of a target firm, presumably in an effort to maximize bidder shareholder wealth. The bidding firm makes an offer for the target firm's equity. Target capital structure plays a role in this scenario by affecting the offer the bidder is willing to extend to the target equityholders. If the target debt changes in value as a result of the acquisition, then wealth is effectively transferred to (or from) target debtholders from (or to) the equityholders of the combined entity (presumably the bidding firm's equityholders). Therefore in making an offer to a target's shareholders, the

bidding firm's equityholders must consider their expected merger gain net of any wealth transfers to other target firm claimants.

If the target debtholders are expected to gain substantially, then the offer the bidder can afford is decreased. In the extreme the debtholders may gain to such a degree that the bidder's offer will not profit the target equityholders and the merger (although value creating) will not succeed. Alternatively if the target debtholders lose substantially in the event of merger, the bidder may (1) be able to make an acceptable offer to the target equityholders, and (2) still expect to profit even though the combined entity's value is less than the sum of the values of the pre-merged firms. In either case a social loss results.

In chapter two I investigate whether a firm's capital structure affects its likelihood of being targeted. If wealth transfers are indeed significant, firms with debt apt to increase in value from a merger will be less likely targets and firms with debt apt to decrease in value will be more likely targets. I collect a sample of 3,351 firms over the time interval 1977-1989 and examine the relationship between their merger status and their capital structure. I find that firms with a capital structure that is prone to debtholder gains are associated with a significantly smaller takeover likelihood. It is less clear if firms are more able to impose losses on their debtholders also are more likely targets.

In addition to target capital structure's affect on takeover likelihood, target capital structure may affect the premium paid to the equityholders. Presumably the bidder increases the value of target assets by reorganizing these assets (or by combining them with the bidder's own assets). This potential increase in value should be independent of the target's capital structure. If the bidder is willing to pay the target a percentage premium above the value of the assets and if the entire premium accrues to target equityholders, then the target equity premium should increase in leverage. If, however, wealth transfers to and from target debtholders are significant, then this increasing effect of leverage on the target equity premium will be diminished or enhanced. I find that this magnification of the target equity premium exists; however, its magnitude is consistent with wealth transfers to target debtholders. My sample consists of 135 cash tender offers from 1980 through 1988. All firms are trade on NYSE or AMEX and are followed by Value Line Investment Survey.

CHAPTER 2
TARGETING CAPITAL STRUCTURE:
THE RELATIONSHIP BETWEEN RISKY DEBT AND A FIRM'S LIKELIHOOD OF BEING ACQUIRED

2.1 Introduction

In an ideal economy, shareholders of bidding and target firms should have an incentive to pursue all value increasing takeovers.[1] In reality, the incentive to pursue a takeover depends not only on the potential synergy gain,[2] but also on the potential wealth transfers between the shareholders and bondholders of the bidder and target firms.

Two potential wealth transfers are considered in this study. The first is a wealth transfer from the bidder and target equityholders to the target bondholders, thereby acting as a takeover deterrent. Such a wealth transfer occurs if the target bondholders' claims are coinsured by either the bidder's assets or by the synergy itself. As the potential size of this coinsurance effect increases, the likelihood that

[1]A value increasing takeover is where the sum of the value of the two participating firms is less than the value of the combined entity.

[2]The synergy is the difference in value between the value of the combined entity and the sum of the values of the two participating firms.

a takeover bid profits both bidder and target shareholders decreases, and the likelihood of a successful takeover decreases.

The second wealth transfer considered is the bidder's potential ability to expropriate wealth from target bondholders. Such expropriation can occur through a number of means. If the target was not paying the maximum dividends allowable under its debt covenants, then the dividend can be increased, leaving the bondholders with less effective collateral. Similarly, the bidder may be able to link the target into a more highly levered entity, and increase the likelihood of default, by issuing more debt. This transfer from target bondholders to bidder equityholders attracts bidders by increasing the bidder's expected takeover gains. Takeover likelihood should increase in a firm's potential for this type of wealth transfer.

In assessing the effect of leverage on takeover likelihood, obviously, the potential for expropriation or coinsurance of debtholder claims is a function of a firm's debt level. Previous studies assume the likelihood of takeover is monotonically decreasing with the level of a firm's leverage (Palepu, 1986; and Mikkelson and Partch, 1989). However with the potential for expropriation, leverage's impact on takeover likelihood may indeed be nonlinear. All equity firms will not be susceptible to coinsurance or expropriation. Over low debt levels potential

expropriation could actually increase takeover likelihood. Further, at these low levels the risk of the debt is not likely to be sufficient to introduce a substantial coinsurance effect. As leverage increases in this relatively safe region of debt, the potential for expropriation could actually increase takeover likelihood. However, the debt's default risk will also increase as leverage rises. When the risk becomes sufficient, the marginal decrease in takeover likelihood from coinsurance will outweigh the marginal increase from expropriation and takeover likelihood will turn from increasing in leverage to decreasing in leverage. Therefore, a concave function of leverage may better measure these two competing effects.

I examine the impact of leverage on takeover likelihood. With a sample of 3,351 NYSE/AMEX firms, I explore the cross sectional relationship between firms' probability of takeover in time t and the amount and riskiness of their debt at time t-1. I find the following: At low leverage levels, the probability of takeover rises in leverage, and at high leverage levels, the probability of takeover declines in leverage. This finding is consistent with the coinsurance effect dominating where leverage is most likely to be risky, and expropriation appearing where the coinsurance effect is absent or insignificant.

One potential problem with simply analyzing how the level of leverage affects takeover probabilities is that different

firms have different levels of debt capacity. The debt of two firms with identical leverage may have different default probabilities. Firms with greater default probability are more likely to have their debt coinsured in a takeover. Therefore in addition to strict leverage measures I use the firm's average credit rating to measure the risk and amount of a firm's debt. I find that the probability of takeover decreases as the average credit quality of a firm's publicly traded debt declines. Low rated debt is more susceptible to coinsurance while high rated debt is solely susceptible to expropriation.

I find further evidence consistent with the above two results. The probability of takeover decreases as the interactive term of leverage multiplied by the firm's average debt rating increases. Finally, when leverage is included in addition to an interactive dummy for noninvestment grade debt multiplied by leverage, only the leverage term interacted with the dummy for junk debt rating has a negative and statistically significant impact on the probability of takeover.

The remainder of this chapter proceeds as follows: Section 2.2 provides the theoretical background on the relationship between a potential target's capital structure and its takeover likelihood. Section 2.3 discusses the testable implications. Section 2.4 discusses previous relevant literature. Section 2.5 contains a description of

the methodology and Section 2.6 describes the data. Section 2.7 interprets the results and Section 2.8 concludes and proposes possible extensions.

2.2 Capital Structure and Takeover Likelihood

The debt in a firm's capital structure may attract or repel potential bidders. The attraction will be referred to as the expropriation hypothesis, and the repellant effect of capital structure will be referred to as the coinsurance hypothesis.

These hypotheses are more intuitively understood when a debt claim is viewed as ownership of a riskless bond and a short position in a put option on the value of the firm's assets with a strike price equal to the payment due bondholders (Galai and Masulis, 1976). Hence the put option determines the market value of the debt. Any change in the value of the put option transfers value between the debt claimants and the equityholders. A change in either the risk or the value of the underlying asset results in a change in the put option's value, causing a wealth transfer. If the put option increases in value (i.e if risk is increased or asset value decreased), then the bidder's claims[3] decrease in value in the same amount that the target bondholder's claims

[3]The bidder purchases the put option when the target equity is acquired.

increase in value. When the put option increases in value the reverse is true.

These wealth transfers affect takeover likelihood by altering the bidder's expected takeover gain. The synergy gain is divided between the target and bidder stakeholders. If target equityholders require a fixed dollar premium to relinquish control, and this premium is independent of capital structure, then the bidder's takeover gain is the synergy gain net of the target equity premium and net of any wealth transfers to or from target creditors.[4] Thus, the potential bidder profit is smaller if the merger results in wealth transfers to target creditors and larger if the merger expropriates wealth from target bondholders.

2.2.1 The Coinsurance Hypothesis

The coinsurance hypothesis argues that target debtholders gain because their claims are backed by more valuable and/or less volatile assets. Kim and McConnell (1977) argue that the value of target debt should increase when two firms with less than perfectly correlated assets combine because of the reduction in asset variance that occurs when these two firms merge. The reduction in variance reduces the value of the put option, and therefore, leads to a reduction in the value of

[4] Negotiations between target creditors and the bidder is not likely to result in concessions from target creditors, in particular, public bondholders (see Gertner and Scharfstein, 1991).

the equity claims and an equal increase in the value of the risky debt claims.

Israel (1991) argues that the synergy gain created by a merger also decreases the value of the put option. The increase in value of the assets in a merger decreases the expected losses from default. The synergies increase the value of the underlying assets and hence reduce the value of the put option. Since there are costs to mounting takeover bids, bondholders' abilities to siphon off some of the synergy gains reduce the likelihood that the firm will be acquired.

The magnitude of this potential coinsurance effect and hence the magnitude of the deterrent to potential bidders depend on both the amount and risk of the target's debt. The maximum wealth transfer from coinsurance is equal to the difference between the market value of the debt prior to a takeover and the value of the debt if it were risk free. Therefore as the amount and the risk of target debt increase, the potential coinsurance effect increases and takeover likelihood decreases.

However, the coinsurance deterrent may be alleviated through negotiations with debtholders. If the size of the coinsurance effect will poison the acquisition, then the debtholders have an incentive to negotiate with the equityholders. However, the free-rider problem associated with negotiating public securities may undermine any successful renegotiation of the public debt securities

(Grossman and Hart, 1980). If bondholders behave atomistically then any affordable offer for their securities will fail. Each individual bondholder will hold out assuming that the others will accept the offer and they will be the only one to receive the full value of the coinsurance. All bondholders follow this strategy and the tender offer fails.

This implies that coinsurance may be an even larger problem for public debt than with private debt. However, even with debtholders who can effectively renegotiate the coinsurance effect will render the debtholders a portion of the takeover gains. Additionally, if negotiation is costly then the acquisition profits are further reduced.

2.2.2 The Expropriation Hypothesis

The expropriation hypothesis argues that bidders gain by expropriating wealth from target bondholders. As noted in Galai and Masulis (1976), equityholders have an incentive to increase the risk and/or payout to their shareholders the assets of the firm. The bidder may structure the combined firm such that the value of the implicit put option component of target debt increases. One way a bidder could take advantage of target bondholders is by increasing the dividend up to the covenant limit. Alternatively, the combined entity may increase the risk of its current outstanding debt by financing the merger with debt. For instance, forty-nine percent of U.S. Steel's acquisition of Marathon Oil was

financed with debt ($2.88 billion). Standard and Poor's responded by lowering the credit rating of only Marathon Oil's debt using the following rationale:

> For U.S. Steel, the reduced liquidity and substantially increased debt load resulting from the purchase of Marathon's common stock is offset by the greatly increased long term earnings potential and asset protection afforded by the acquisition. However, the potential call upon Marathon's cash flow and assets to service the acquisition debt, as well as the general cash needs of the combined entity negatively impacts the ability of Marathon to maintain financial flexibility on a par with previous levels (*Standard and Poor's Creditweek*, January 4, 1982, p.1885).

The degree to which a bidder can benefit from expropriating wealth from target bondholders depends on the amount and covenant protection of the target's debt. Ceteris paribus, firms with a greater potential for wealth expropriation will be more profitable targets. The maximum size of wealth expropriation is equal to the market value of the debt, the difference between its value at its pre-takeover risk and its value if it were infinitely risky (zero). In the absence of covenant protection safer debt has a greater potential for expropriation than riskier debt. However, the risk of the debt and its covenant protection are clearly correlated. Risky debt therefore may be subject to expropriation and coinsurance. Safe debt, however, will only be subject to expropriation (because the risk is insufficient to introduce significant coinsurance). The more safe debt a firm issues the greater the potential amount of expropriation.

Therefore the probability of takeover is hypothesized to be increasing in the firm's amount of safe debt. Note, however, that if bond covenants protect debtholders from expropriation, then the amount of safe debt will have no impact on the probability of takeover.

2.3 Testable Implications

The coinsurance and expropriation hypotheses argue that a firm's takeover likelihood depends on the riskiness and amount of its debt. Specifically, the coinsurance hypothesis conjectures that a firm's takeover likelihood decreases as it increases its amount of "risky" debt. The expropriation hypothesis coupled with the potential for coinsurance argues that a firm's takeover likelihood increases as it increases its sufficiently "safe" debt.

A firm's leverage ratio (debt to assets ratio) is a potential measure of the amount and risk of its debt outstanding. A firm's leverage ratio rises if the face value of the debt rises and/or the risk rises. Over low leverage levels the debt should tend to be relatively "safe" while at "high" leverage levels the debt should tend to be relatively "risky." Therefore the first testable implication is that over low leverage levels takeover likelihood increases in or is invariant to increases in leverage, and over high leverage levels takeover likelihood decreases in leverage.

The above approach may have shortcomings in that firms' debt capacities differ. For example some firms may issue large amounts of very safe debt. Therefore, I use a firm's credit rating to measure the risk of its debt. A firm's credit rating should also incorporate the amount and risk of a firm's debt. A high credit rating implies safe debt, subject only to expropriation, while a low credit rating implies risky debt, potentially subject to coinsurance in addition to expropriation. Therefore, firms with safe credit ratings should be more attractive targets than firms with risky credit ratings, implying takeover likelihood is decreasing in credit rating.

2.4 Previous Evidence

Two strands of the finance literature provide evidence on the takeover likelihood/capital structure relationship. The first is a group of studies which examine the determinants of takeover likelihood. The other relevant literature consists of a group of studies that examine target bondholder returns to the announcement of a takeover. None of these studies provides conclusive evidence regarding the expropriation or coinsurance hypotheses.

2.4.1 Empirical Evidence of Leverage on Takeover Likelihood

Studies by Palepu (1986), Mikkelson and Partch (1989), and Ambrose and Megginson (1992) all provide evidence on the

determinants of takeover likelihood. Although none of these studies focuses directly on the effect of leverage, leverage is included as an explanatory variable. These studies use a logit model to estimate the effects of the hypothesized determinants of takeover likelihood. Because this paper uses methodology similar to that found in these studies, a detailed description follows.

Palepu (1986) sets out to construct a predictive model of takeover likelihood. Among his determinants of takeover likelihood, he includes a firm's leverage ratio, measured as the book value of long term debt divided by the sum of the liquidating value of preferred stock and book value of equity, as an explanatory variable of takeover likelihood. Palepu's sample consists of 163 firms acquired between 1971 and 1979, and 256 nontarget firms. All of the firms are traded on the New York or American stock exchange, can be located on the CRSP and COMPUSTAT tapes, and belong to the mining or manufacturing industries. Palepu's logit model yields a negative, statistically significant (five percent level) coefficient on leverage. This finding is consistent with the coinsurance argument. Because the focus of his study is not on leverage, Palepu does not examine "safe" leverage separately from "risky" leverage.

A number of problems may arise in Palepu's methodology. In estimating his logit model, Palepu (1986) employs data for target firms as of the fiscal year-end prior to the year in

which the takeover occurred. For unacquired firms, however, the data are as of fiscal year-end 1979. Because the timing of the data differs across takeover status, differences in variable values due to time trends may be attributed to takeover status.[5]

Additionally, because Palepu (1986) includes mergers from 1971 through 1979, takeovers from the early seventies are implicitly assumed to be motivated in the identical manner as those in the late seventies. A large enough time window is necessary to obtain a sufficient number of acquired firms; however, without controls for merger trends, a nine year time span may introduce significant bias (see for example Bradley, Desai, and Kim, 1988).

Mikkelson and Partch (1989) develop a similar logit model in their examination of the impact of managerial ownership on takeover likelihood. They randomly select 240 firms existing on the CRSP tapes in 1972. They then collect additional data for these firms from the 1972 *Moody's Industrial Manual*. These firms are tracked through 1987. As a firm departs from their sample, due to acquisition, bankruptcy, or liquidation, the firm first appearing on the CRSP tapes after the delisted

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[5]Palepu (1986) attempts to correct for this by adjusting all the independent variables. Each variable is adjusted by the average value of the independent variable for the population of 2,054 firms on COMPUSTAT that initially qualified for inclusion in his sample. However, mean values of these independent variables may vary drastically across industries. Also, time trends in the independent variables may be industry specific. This correction may do little to alleviate the sample bias problem.

firm exits is added to the sample. They collect data for 1973, 1978, and 1983 and determine whether a company experienced a change in control in the subsequent four years. They then pool the data and implement a logit model. Their leverage variable is constructed as the book value of debt divided by the sum of the book value of debt, preferred stock, and the market value of equity.

In contrast to Palepu (1986), Mikkelson and Partch (1989) find a statistically insignificant effect of leverage on takeover likelihood. As with Palepu the focus of Mikkelson and Partch's study is other than leverage. Hence, they too fail to separate "safe" leverage from "risky" leverage.

Ambrose and Megginson (1992) examine the impact of assets structure on takeover likelihood. In their sample the mean leverage for targets is greater than that of nontargets, although the difference is not statistically meaningful. In examining target asset structure, they find that takeover likelihood increases in the target's ratio of plant property and equipment to total assets. They do not, however, include leverage in their model.

2.4.2 Returns to Bondholders of Acquired Firms

Several studies provide evidence regarding takeover initiated wealth transfers from and to target bondholders. Kim and McConnell (1977) examine a sample of 44 bond issues from 39 completed mergers in the time period from 1960 to

1973. They calculate abnormal returns for these bonds 12 months prior to, and 11 months following, the merger. They fail to find significant abnormal returns to target bondholders. Their results lead them to two possible conclusions:

> It may be that we are observing the wrong set of firms, in the sense that managers (or stockholders) only engage in mergers with firms that will generate little coinsurance or that they take other steps to circumvent the wealth-transfer. (p.362)

"Other steps" to offset the gain to target bondholders are risk increasing actions. Such actions may include increasing the firm's leverage after the takeover is complete. Kim and McConnell (1977) compare the leverage of the two firms prior to the takeover with the leverage of the merged entity ex-post merger. They find evidence that merged entities do indeed increase their leverage after the merger.[6] They infer that the market anticipates the risk increasing action, eliminating any target bondholders gains.

Dennis and McConnell (1986) and Asquith and Kim (1982) find insignificant abnormal returns to bondholders of acquired firms. Dennis and McConnell (1986) recognize that coinsurance potential increases with the risk of the outstanding debt. They inspect the returns to only those

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[6]In order to influence existing debt, new debt must effectively alter the priority of the existing debt. This can be done by issuing higher or equal priority debt, or by issuing shorter maturity debt. The existence of restrictive covenants on the existing debt may preclude such new debt issues.

acquired firms' bonds with a BBB bond rating or lower. As in the other studies, Dennis and McConnell find no evidence that target bondholders gain in takeovers, even after separating the bonds by rating.

Asquith and Kim (1982) examine the returns to all stakeholders of the target and acquiring firm. They conclude that only target equityholders earn abnormal returns. In finding no abnormal bond returns they conclude that either the "incentive" effect (expropriation) or the "diversification" effect (coinsurance) do not exist, or these effects offset one another.

Careful interpretation of the evidence from these studies with regard to the coinsurance and expropriation hypotheses is required. With the exception of Dennis and McConnell, these studies fail to divide the sample into those bonds which are most likely to suffer from expropriation, and those more likely to gain from coinsurance. When Dennis and McConnell do examine the returns to risky bondholders, their sample is conditional on a successful takeover. To be included in their sample, the firm must have been acquired which systematically eliminates any firms with bonds that would undergo prohibitive coinsurance. Thus, perhaps it is not surprising these bonds were not found to significantly gain.

2.5 Methodology

To assess the impact of capital structure on takeover likelihood, I use a standard logit model, as defined by equation (1). This logit model relates firm i's probability of takeover at time t, $P_{i,t}$, as a function of its characteristics at time t-1.

$$P_{i,t}=\frac{e^{f(DEBT_{i,t-1},\theta)+x'_{i,t-1}\beta+\epsilon_i}}{1+e^{f(DEBT_{i,t-1},\theta)+x'_{i,t-1}\beta+\epsilon_i}} \qquad (1)$$

These characteristics include a function of firm i's debt, $f(DEBT_{i,t-1},\theta)$, and a vector of other important firm characteristics, $x_{i,t-1}$. θ and β are vectors of parameters to be estimated via maximum likelihood. As discussed in section 2.2, the expropriation and coinsurance hypotheses should be apparent in "safe" debt and "risky" debt respectively. Therefore, the functions of debt used in this study attempt to separate debt into these two categories.

As argued previously, low levels of leverage will be comprised of primarily safe debt while high levels will be comprised of primarily risky debt. The difficulty is in choosing the leverage level which defines the end of safe debt and the beginning of risky debt. To avoid arbitrarily choosing this switch point I use a quadratic function of leverage, $f(DEBT_{i,t-1},\theta)=\theta_1 Lev_{i,t-1}+\theta_2(Lev_{i,t-1})^2$. This specification allows the relationship between leverage and takeover

likelihood to be different over the "high" and "low" levels. The value of leverage at the cutoff point equals the quadratic's implied turning point (maximum), $Lev^{*}=\theta_1/(2Lev_{i,t-1}\theta_2)$. Because θ_1 and θ_2 are freely estimated, this cutoff point is chosen by the data rather than by some arbitrary method. The expropriation hypothesis implies an increasing relationship between leverage and takeover likelihood over "safe" leverage while the coinsurance hypothesis implies a decreasing relationship over "risky" leverage. Finding $\theta_1>0$ and $\theta_2<0$ is consistent with these hypotheses.[7]

A firm's average bond rating provides an alternative measure of a firm's susceptibility to coinsurance and expropriation. Therefore, I use a firm's average bond rating in the function of leverage in equation (1).

Leverage may measure a firm's amount of debt more accurately while the bond rating may better capture the risk. The final measures of debt used in equation (1) consist of functions of both leverage and bond rating. The first is the interactive term of leverage multiplied by debt rating: $f(DEBT_{i,t-1},\theta)=\theta_1 Lev_{i,t-1}*BNDRATE_{i,t-1}$.

Another manner of testing the implication that increasing "risky" debt deters bidders while increasing "safe" debt

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[7]Because the logit model is already a nonlinear transformation of the explanatory variables this may not be obvious. However, because the logit transformation is monotonic, this result readily follows. For a more detailed discussion see the appendix.

attracts bidders is by using debt rating to separate risky from safe debt. Leverage of firms with junk ratings are separated from those with investment grade ratings. Through the use of an interactive dummy variables, the effect of "risky" leverage is contrasted with "safe" leverage. The dummy value takes on a value of one when the rating is below investment grade. This allows for the direct test of whether the effect of "risky" leverage differs from that of "safe" leverage.

2.6 Sample and Data Description

2.6.1 The Sample

The firms included in the sample are obtained in the following manner. First, all firms from the 1989 COMPUSTAT research and industrial tapes form the basis of the sample (these firms could have existed for any interval from 1977-1989). Only those found on the CRSP tapes are included. Next, all firms in regulated industries, all financial firms, and all firms not on the New York or American Stock exchange are deleted.[8] The resulting sample consists of 3,351 individual firms. Acquired firms are identified by their CRSP delisting codes.

The data are divided into four sub-periods spanning the time period from 1977 through 1989. Each sub-period contains

[8]All firms in SIC codes 4811, 4900-4947, and 6000-6999 were eliminated.

three fiscal years: 1978-1980, 1981-1983, 1984-1986, 1987-1989. The prior year's data are employed to estimate equation (1), where the dependent variable is one if the firm was acquired in any of the next three fiscal years. For example, the 1977 fiscal year-end characteristics are coupled with whether or not the firm was acquired in fiscal years 1978, 1979 or 1980. These data requirements limit the number of firms in each sub-period to those firms in existence the year prior to the sub-period (i.e. 1977, 1980, 1983, or 1986).

This implies a firm can exist in up to four sub-periods. The 3,351 different firms amount to 6,081 observations when the data are pooled. Due to this sample selection technique, a significant effect of an independent variable is interpreted as affecting the probability a firm will be acquired within the subsequent three years.

2.6.2 Variable Definitions

The determinants of takeover likelihood are discussed below along with the manner in which they are measured.

Leverage: MK1DA, BK1DA, MK2DA, and BK2DA

Four measures of leverage are utilized. The models are tested using all measures to check for robustness. These measures are defined as follows:

BK1DA = TD/(TD+PS+CET)

MK1DA = TD/(TD+PS+MVE)

BK2DA = (TD+PS)/(TD+PS+CET)

MK2DA = (TD+PS)/(TD+PS+MVE)

where TD is the book value of the sum of short term and long term debt; CET is book value of tangible common equity; PS is the liquidating value of preferred stock; and MVE is the market value of equity. These measures are summarized in table 2-1. All empirical models are tested using all leverage measures. MK2DA and BK2DA include preferred stock in the numerator as well as denominator because, as Harris and Raviv (1991) note, Israel's (1991) theory applies to all nonvoting, risky, fixed income securities (i.e. preferred stock may be coinsured). Similarly, preferred stock may be vulnerable to expropriation.

The other primary difference between the measures of leverage is that BK1DA and BK2DA consist entirely of book values while MK1DA and MK2DA include the market value of common stock in place of the book value of common stock. Although these measures are highly correlated, their significance to takeover likelihood may be quite different. Both measures will reflect the addition of long term debt; however, MK1DA and MK2DA are obviously more sensitive to changes in the market value of the firm.

Average Bond Rating: Moody's and S&P

For a sub-sample of these firms the Moody's and Standard and Poor's ratings were acquired from the *Lehman Brothers*

Fixed Income Indices Tape (distributed by the University of Wisconsin, Milwaukee, School of Business Administration). Bond issues included on this tape must be in the amount of $25 million or more and must not contain or be tied to any options, other than simple callability and putability.

For all specifications that include rating information the sample drops from 6,081 to 1,141 and 1,149 when Moody's and Standard and Poor's ratings are used respectively. Of note, this systematically eliminates all equity firms (208 observations) and all firms lacking rated public straight debt from equations which require a debt rating. A firm may have multiple issues; so I construct a face value weighted average of all the firm's issues on the tape. Moody's is the value weighted average Moody's rating. S&P is the value weighted average Standard and Poor's rating. The highest credit rating has a value of one while the lowest credit rating has a value of 23. Values of 1 through 11 refer to investment grades while 12 through 23 refer to junk ratings.

Control variables for equation (1)

Other variables besides leverage affect takeover likelihood. Many of these variables may be correlated with leverage. Below is a list of control variables I use in this study.

Industry takeover control: ITO

ITO is the percentage of firms, within a four digit SIC code, acquired in the fiscal year two years prior to the sub-period. For example, in the logit equation relating acquisitions in 1978-1980 to leverage in 1977, ITO is the percentage of firms acquired within a given firm's industry in 1977. ITO is meant to control for industry takeover waves. Therefore the predicted sign on ITO is positive.

Profitability: DEVROA

Takeover likelihood may be determined by a firm's profitability. Highly profitable firms may make better targets if the synergies stem from complimentary products or services. For example a bidder with distribution expertise will generate larger synergies with a target producing high demand goods as opposed to low demand goods. Alternatively, takeovers may be used to discipline or restructure poor performing firms. To measure a firm's success, this study uses DEVROA, which is equal to its return on assets less the average return on assets (not including itself) for the firms in its four digit SIC code. The measurement year is the same year in which leverage is measured.

Firm Size: EQ

Palepu (1986), Mikkelson and Partch (1989), and Ambrose and Megginson (1992) find size reduces takeover likelihood

significantly. Firm size may reduce takeover likelihood because (1) financing costs to acquire a large firm are prohibitive or (2) the cost of integrating a firm into a bidder increases in target size. The natural log of a firm's market value of equity is used to control for size and the predicted sign of its coefficient is negative.[9]

Asset Structure: PPE

Ambrose and Megginson (1992) argue that acquirers prefer firms rich in fixed assets. They find plant, property and equipment to be a significant determinant of acquisition likelihood. PPE is the net plant property and equipment as a proportion of total assets. The finding of a positive coefficient on PPE would be consistent with Ambrose and Megginson.

Takeover Activity: D1,D2,D3

Takeover activity may vary across the four sub-periods.[10] Therefore, I include dummy variables to control for time trends. D1, D2, and D3 are equal to one when an observation comes from the 78-80, 81-83, and 84-86 time periods respectively. They are equal to zero otherwise.

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[9]Total assets was substituted for EQ and virtually identical results were obtained.

[10]Table 1-1 on the following page illustrates the varying degree of takeover activity in each of the four sub-periods.

2.6.3 Sample Statistics

Table 2-1 describes the full sample (6,081 observations), and table 2-2 provides information on the bond ratings. Of note, the proportion of firms acquired is greater in the first two sub-periods than in the latter two. This may be due to the exclusion of leveraged buyouts from the sample. LBOs were prevalent in the latter two periods, but not as prolific in the first two sub-periods. Also of note in table 2-2, 75 percent of the observations have investment grade ratings and 25 percent have junk ratings.

Table 2-1
Sample Means and Standard Deviations

Variable	Mean	Std. Dev.
% Acquired : Whole Sample	.13337	
% Acquired : 1978-1980	.15311	
% Acquired : 1981-1983	.15557	
% Acquired : 1984-1986	.10903	
% Acquired : 1987-1989	.12068	
Leverage: with Mkt. Eq. : MK1DA	.31243	.22081
Leverage: with Bk. Eq. :BK1DA	.37370	.51900
Lev: MK1DA and Pfd=debt : MK2DA	.33004	.23371
Lev: BK1DA and Pfd=debt : BK2DA	.39659	.54195
Return on Assets : ROA	.14182	.09872
ROA less Industry ROA : DEVROA	-.12903E-3	.08288
Total Assets : TA (mill.)	1,255.3	4,951.5
Mkt. Val. of Eqty : EQ (mill.)	783.11	2,65.6
Industry takeover control : ITO	.00824	.03021
Net Plant,Prop,and Equip : PPEN	.35858	.19970

Table 2-2
Frequency distribution of the amount outstanding weighted average bond ratings of firms' straight public debt.

			Standard & Poor's			Moody's		
Mdy's Rat.	S&P Rat.	Givn. Value	Count	Freq.	Cum. Freq.	Count	Freq.	Cum. Freq.
AAA+	Aaa+	1	0	0	0	0	0	0
AAA	Aaa	2	63	.055	.055	63	.055	.055
AA+	Aa1	3	13	.011	.067	23	.020	.075
AA	Aa2	4	161	.141	.709	125	.109	.184
AA-	Aa3	5	42	.037	.245	51	.044	.228
A+	A1	6	74	.065	.309	81	.071	.299
A	A2	7	275	.241	.550	264	.230	.528
A-	A3	8	53	.047	.597	70	.061	.589
BBB+	Baa1	9	60	.053	.649	44	.038	.628
BBB	Baa2	10	109	.096	.769	121	.105	.733
BBB-	Baa3	11	27	.024	.769	43	.037	.770
BB+	Ba1	12	14	.012	.781	27	.024	.794
BB	Ba2	13	30	.026	.807	39	.034	.828
BB-	Ba3	14	74	.001	.828	23	.020	.848
B+	B1	15	146	.128	.550	145	.126	.974
B	B2	16	14	.012	.968	18	.016	.990
B-	B3	17	3	.003	.971	10	.009	.998
CCC+	Caa1	18	1	.001	.972	0	.000	.998
CCC	Caa2	19	13	.011	.983	2	.002	1
CCC-	Caa3	20	1	.001	.968	0	0	1
CC	Ca	21	19	.016	0	0	0	1
C	C	22	0	0	1	0	0	1
D	D	23	0	0	1	0	0	1

2.7 Results

2.7.1 Takeover likelihood as a monotonic function of leverage

Table 2-3 contains the results from estimating equation (1) with leverage only. Regardless of the measure of leverage (MK1DA, BK1DA, MK2DA, or BK2DA) the coefficient on leverage is insignificantly different from zero. This is consistent with the results of Mikkelson and Partch (1989) and Ambrose and Megginson (1992), and contrasts with the results of Palepu (1986). In all four specifications the coefficients on firm size, Log EQ, firm industry takeover activity, ITO, and the firm proportion of fixed assets, PPE, are significant and have the predicted sign. Further, the signs and significance levels of these coefficients are consistent with those found in the previously mentioned studies. The firm's profitability relative to its industry, DEVROA, does not appear to influence takeover likelihood.[11]

2.7.2 The Quadratic Function of Leverage

Results for the first specification which includes a quadratic function of leverage are contained in table 2-4. The coefficient estimates on the leverage term and leverage squared term are positive and negative respectively, as the coinsurance and expropriation hypotheses conjecture. However, only the leverage measures using market equity values result

[11]DEVROA was replaced with straight return on assets. No difference in the significance of either the variable or the entire model was found.

Table 2-3
Logit of takeover status on leverage.
(Asymptotic t-stats. in parentheses)

	LEVERAGE MEASURES :			
	MK1DA	BK1DA	MK2DA	BK2DA
Const.	-1.5386 (-11.01)***	-1.5611 (-12.77)***	-1.5087 (-10.85)***	-1.5514 (-12.57)***
1978-80 Dummy	0.4454 (3.99)***	0.4510 (4.04)***	0.4435 (3.97)***	0.4533 (4.06)***
1981-83 Dummy	0.4699 (4.36)***	0.4757 (4.44)***	0.4654 (4.32)***	0.4764 (4.44)***
1984-86 Dummy	-0.0227 (-0.20)	-0.0215 (-0.19)	-0.0239 (-0.21)	-0.0213 (-0.19)
DEVROA	0.3882 (0.80)	0.4248 (0.90)	0.3249 (0.67)	0.3970 (0.83)
ITO	3.2513 (3.01)***	3.2462 (3.01)***	3.2547 (3.01)***	3.2525 (3.01)***
Log EQ	-0.1761 (-7.46)***	-0.1736 (-7.68)***	-0.1788 (-7.60)***	-0.1742 (-7.70)***
PPE	0.6887 (3.94)***	0.6681 (3.44)***	0.7158 (3.53)***	0.6750 (3.47)**
LEV	-0.0909 (-0.47)	-0.0352 (-0.39)	-0.1624 (-0.88)	-0.0587 (-0.60)
No.Obs.	6,081	6,081	6,081	6,081
X^2.(8)	95.83***	95.80***	96.38***	96.08***

*** Denotes significance at the 1% level
** Denotes significance at the 5% level
* Denotes significance at the 10% level

Table 2-4
Logit of takeover status on leverage and leverage squared.
(Asymptotic t-stats. in parentheses)

	LEVERAGE MEASURES :			
	MK1DA	BK1DA	MK2DA	BK2DA
Const.	-1.7122 (-11.39)***	-1.4857 (-11.46)***	-1.7072 (-11.35)***	-1.4614 (-11.32)***
1978-80 Dummy	0.4584 (4.10)***	0.4402 (3.94)***	0.4599 (4.11)***	0.4396 (3.93)***
1981-83 Dummy	0.4845 (4.49)***	0.4599 (4.27)***	0.4824 (4.47)***	0.4556 (4.23)***
1984-86 Dummy	-0.0140 (-0.13)	-0.0232 (-0.21)	-0.0159 (-0.14)	-0.0252 (-0.23)
DEVROA	0.4857 (0.99)	0.2545 (0.53)	0.3976 (0.80)	0.1753 (0.37)
ITO	3.2557 (3.01)***	3.2841 (3.04)***	3.2031 (2.96)***	3.2669 (3.02)***
Log EQ	-0.1887 (-7.88)***	-0.1859 (-7.78)***	-0.1913 (-8.02)***	-0.1891 (-7.95)***
PPE	0.6979 (3.42)***	0.7608 (3.76)***	0.7181 (3.51)***	0.7913 (3.91)**
LEV	1.7927 (3.09)***	0.0099 (0.15)	1.8622 (3.32)***	0.0094 (0.15)
LEV^2	-2.5538 (-3.44)***	-0.4231 (-1.62)	-2.6244 (-3.81)***	-0.4978 (-2.07)**
No.Obs.	6,081	6,081	6,081	6,081
X^2.(9)	108.24***	98.39***	112.18***	100.29***

*** Denotes significance at the 1% level
** Denotes significance at the 5% level
* Denotes significance at the 10% level

in statistically significant coefficients. The other control variables have virtually identical coefficients and significance levels as those in table 2-3.

The leverage switch point predicted by the MK1DA (pfd. stock classified as equity, and common equity measured as the market value) is at .3510 = 1.7927/(2*2.5538). This implies that the expropriation effect dominates when leverage is below .3510 and the coinsurance effect dominates over levels above .3510. Similar results obtain when leverage is measured with the market value of equity and preferred stock classified as debt, MK2DA. In this case the implied cutoff point is .3548 = 1.8622/(2*2.6244).

When book values of equity are used to compute leverage the results are mixed. The coefficient on leverage is positive yet insignificant and the coefficient on the leverage squared term is negative and significant only for the measure including preferred stock as debt (BK2DA). These measures fail to render evidence consistent with the expropriation hypothesis, and provide weak evidence, when BK2DA is used, in favor of the coinsurance hypothesis (in the form of a negative statistically significant at the 5 percent level coefficient on the leverage squared term).[12]

In addition to their statistical importance, the coefficients on the leverage terms, using market values of

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[12]This may be due to the failure of book equity to adequately reflect the risk of the debt.

equity, are economically meaningful. Using the mean values of all the other explanatory variables I calculate the implied probability of takeover for different leverage values. The results are in table 2-5. The resulting probabilities imply that a firm's takeover likelihood undergoes economically significant changes as leverage changes. Although not reported, the implied probabilities using leverage measured with the market value of equity and classifying preferred stock as debt, MK2DA, renders similar predicted probabilities.

Table 2-5
Predicted probability of takeover for various measures of leverage.
(Sample means are used for all other variables)

Lev = MK1DA	Lev^2 = $MK1DA^2$	Prob. of TO
0	0	10.77%
0.1	0.01	12.33%
0.2	0.01	13.49%
0.3	0.09	14.10%
0.1	0.16	14.11%
0.5	0.25	13.51%
0.6	0.49	12.36%
0.7	0.49	10.80%
0.8	0.69	8.99%
0.9	0.81	7.11%
1	1	5.34%
Max = 0.350987	0.123192	14.18%

2.7.3 Bond Rating

The results using a firm's average bond rating are contained in the left panel of table 2-6. The coefficients on both Moody's and Standard and Poor's bond ratings are negative and statistically significant at the 5 and 1 percent level respectively. Again, this is consistent with the coinsurance and expropriation hypotheses. Firms with safe debt will attract bidders with potential expropriation gains. Firm's with risky debt will repel bidders with potential coinsurance losses. Hence, firms with safe ratings will have a greater takeover likelihood than firms with risky debt. Of note is the change in significance of the control variables. The industry control variable, ITO, and the proportion of fixed assets, PPE, are insignificant in these two specifications. One possible reason for this difference from their significance from table 2-2 is the systematic reduction of the sample. The existence of a bond rating excludes all equity firms and excludes firms lacking widely held public debt. This sub-sample may be subject to greater coinsurance because of the free rider problem associated with public securities (Grossman and Hart, 1980). Size (Log EQ) remains a significant factor.

Table 2-6
Logit of takeover status on bond rating and
on bond rating interacted with leverage.
(Asymptotic t-stats. in parentheses)

	BOND RATING MEASURES		BOND RATING * LEVERAGE[a]	
	S&P	Moody's	S&P*MK1DA	Mdy's*MK1DA
Constant	0.1235 (0.14)	0.0074 (0.00)	-0.6295 (-0.89)	-0.5854 (-0.84)
1984-86 Dummy	1.3027 (3.38)***	1.1538 (3.13)***	1.2321 (3.23)***	1.1000 (3.01)***
1981-83 Dummy	1.6419 (4.91)***	1.5013 (4.76)***	1.5790 (4.77)***	1.4463 (4.63)***
1984-86 Dummy	0.4268 (1.16)	0.3867 (1.13)	0.4091 (1.12)	0.3642 (1.07)
DEVROA	-0.0328 (-0.02)	-0.8415 (-0.43)	-0.8658 (-0.42)	-1.8399 (-0.92)
PPE	3.7245 (1.26)	3.4102 (1.17)	3.4758 (1.17)	3.2149 (1.09)
Log EQ	-0.3765 (-3.58)***	-0.3480 (-3.28)***	-0.3396 (-3.47)***	-0.3280 (-3.39)***
PPE	-0.3339 (-0.57)	-0.3053 (-.054)	-0.0536 (-0.09)	-0.0176 (-0.03)
Bond Rtng	-0.1076 (-2.80)***	-0.0978 (-2.35)**		
Rtng*LEV			-0.1476 (-2.67)***	-0.1426 (-2.51)**
X^2 (8)	41.64***	37.18***	41.23***	38.32***
No. Obs.	1,141	1,149	1,141	1.149

[a]The reported results include leverage measure with the market value of equity and preferred stock classified as equity.

*** Denotes significance at the 1 percent level
** Denotes significance at the 5 percent level
* Denotes significance at the 10 percent level

Table 2-7
Predicted probability of takeover for the different bond ratings. Sample means are used for the value of the other variables. The coefficient estimates are from the estimations in columns 1 and 2 of table 2-6.

Mdy's Rat.	S&P Rat.	Givn. Value	S&P Prob. of TO	Moody's Prob. of TO
AAA+	Aaa+	1	14.04%[a]	13.76%[a]
AAA	Aaa	7	12.80%	12.64%
AA+	Aa1	8	11.64%	11.60%
AA	Aa2	4	10.58%	10.63%
AA-	Aa3	8	9.61%	9.74%
A+	A1	8	8.71%	8.91%
A	A2	7	7.89%	8.15%
A-	A3	8	7.15%	7.44%
BBB+	Baa1	8	6.46%	6.80%
BBB	Baa2	10	5.84%	6.20%
BBB-	Baa3	14	5.28%	5.66%
BB+	Ba1	10	4.77%	5.16%
BB	Ba2	14	4.30%	4.70%
BB-	Ba3	14	3.88%	4.28%
B+	B1	10	3.50%	3.90%
B	B2	14	3.15%	3.55%
B-	B3	14	2.84%	3.23%
CCC+	Caa1	18	2.56%	2.94%
CCC	Caa2	19	2.30%	2.67%
CCC-	Caa3	20	2.07%	2.43%[a]
CC	Ca	21	1.87%	2.21%[a]
C	C	22	1.68%[a]	2.00%[a]
D	D	23	1.51%[a]	1.82%[a]

a - these ratings are beyond the range of ratings in the sample.

The impact of bond rating on takeover likelihood is not only statistically significant, it is also economically significant. Table 2-7 provides predicted takeover probabilities using various bond ratings and the sample means of all other variables.[13] The highest investment grade rating is associated with a probability of takeover almost three times that of the highest noninvestment grade rating.

2.7.4 The Interaction of Leverage and Bond Rating

The interaction of leverage and bond rating should capture both the amount and risk of a firm's debt with greater accuracy than either measure by itself. The results from using interactive variable renders results similar to the bond rating specifications (see right panel of table 2-6 above). When the interactive term includes leverage measured with the market value of equity, the resulting coefficient is negative and statistically significant at the 5 percent and 1 percent level for Moody's and S&P ratings respectively. With leverage measured with book equity (not shown), the coefficient is negative and statistically significant at the 5 and 10 percent level using the Standard and Poor's and Moody's ratings respectively. Again, these specifications results support the coinsurance and expropriation hypotheses.

[13]In this case the sample means are the means for the observations included in the logit estimations in Table 6-1.

2.7.5 Using Dummy Interactives and Leverage

If noninvestment grade debt is subject to significant coinsurance, then as the amount of noninvestment grade debt increases takeover likelihood decreases. Similarly, if investment grade debt is somewhat immune to coinsurance thereby subject only to expropriation, then as investment grade debt increases takeover likelihood increases. Using a dummy interactive variable for firms with noninvestment grade debt, risky leverage is tested to be different from the effect of average leverage (see table 2-8 below for results using leverage with preferred stock classified as equity). The resulting coefficient is negative and statistically significant at the 5 percent level in all cases, and at the 1 percent level when leverage is measured with the book value of equity. This result is independent of the classification of preferred stock (as debt or equity).

This evidence indicates that risky debt deters takeovers, consistent with the coinsurance hypothesis. Of note, the effect of investment grade leverage is insignificantly different from zero in this specification, as opposed to positive as the expropriation hypothesis indicates. One potential explanation for this may be due to the exclusion of all equity firms and firms with only private debt, who can not attract bidders with potential expropriation, and hence are less attractive targets.

Table 2-8
Logit of takeover status on leverage and a dummy for noninvestment bond rating interacted with leverage.
(Asymptotic t-stats. in parentheses)

	S&P JUNK DUMMY * LEV:		Mdy's JUNK DUMMY * LEV	
	LEV=MK1DA	LEV=BK1DA	LEV=MK1DA	LEV=BK1DA
Constant	-1.009 (-1.45)	-1.1243 (-1.77)*	-0.8878 (-1.32)	-1.0194 (-1.66)*
1978-80 Dummy	1.2592 (3.29)***	1.2821 (3.32)***	1.1236 (3.07)***	1.1384 (3.08)***
1981-83 Dummy	1.6151 (4.84)***	1.6811 (5.01)***	1.4852 (4.71)***	1.5526 (4.90)***
1984-86 Dummy	0.4134 (1.13)	0.4519 (1.23)	0.3741 (1.10)	0.4151 (1.21)
DEVROA	0.1639 (0.08)	0.4642 (0.22)	-1.1006 (-0.53)	-0.8193 (-0.40)
ITO	3.3734 (1.14)	3.6108 (1.20)	3.0311 (1.03)	3.1842 (1.06)
Log EQ	-0.3090 (-3.25)***	-0.3231 (-3.49)***	-0.3057 (-3.29)***	-0.3200 (-3.53)***
PPE	-0.3182 (-0.51)	-0.4657 (0.78)	-0.2146 (-0.35)	-0.3653 (-0.63)
LEV	-0.5325 (-0.06)	0.6594 (1.20)	-0.1818 (-0.22)	0.6189 (1.15)
JUNK*LEV	-1.6967 (-2.30)**	-1.9135 (3.10)***	-1.5807 (-2.19)**	-1.9439 (-3.10)***
X^2 (9)	40.38***	44.37***	38.27***	42.50***
No. Obs.	1,141	1,149	1,141	1.149

*** Denotes significance at the 1 percent level
** Denotes significance at the 5 percent level
* Denotes significance at the 10 percent level

However, I reran this specification with the all equity firms included. Because these all equity firms lack any debt they have a value of zero for "junk." Again, the coefficient on the leverage term is insignificant while the coefficient on the interactive dummy multiplied by leverage is negative and statistically significant regardless of the measure used. These results are more suggestive of a coinsurance effect and less suggestive of an expropriation effect.

2.7.6 Potential Endogeneity Problem

If managers realize that capital structure impacts takeover likelihood, then a firm facing an undesirable probability of takeover may change its capital structure (Israel, 1992). If debt is used defensively (or offensively) then the causality is reversed (takeover likelihood determines capital structure), and the logit models suffer from endogeneity.

Firms with an unwanted high takeover likelihood may issue risky debt or increase the risk of their current debt to deter the threat. This would cause high takeover likelihood to be associated with risky debt, and in the logit specification biases the evidence towards the presumably false conclusion that risky debt attracts takeovers, and biases the evidence from supporting the coinsurance hypothesis. In terms of the empirics, this would upwardly bias the coefficient on bond

rating, and therefore hinder finding a negative coefficient as the expropriation and coinsurance hypothesis predict.

To determine if an endogeneity problem exists, I examine a firm's bond rating as a function of its probability of takeover. If firms facing a high takeover likelihood entrench themselves by increasing their risky debt, then the bond rating variable should take on high levels as the probability of takeover increases. If endogeneity is a problem then as takeover likelihood increases the managers will attempt to deter bidders by taking risk increasing action (which lowers their credit quality). To see if takeover likelihood indeed causes changes in a firm's credit quality, a measure of the probability of takeover that is exogenous to bond rating is needed. Two methods of estimating the probability of takeover (PTO) are used.

The first method uses a simple instrument for PTO. The percentage of firms acquired in the firm's industry the year prior to the date of the bond rating, ITO, proxies for PTO in the first specifications. The results of the OLS regression of bond rating on ITO, the instrument for PTO, and other control variables are contained in table 2-9 below.[14]

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[14]The other explanatory variables included are ROA, a firm's return on assets, and Log of TA is the log of a firm's total assets. ROA attempts to control for a firms ability to meet current debt payments while Log of TA controls for the diversification of large firms. This diversification is hypothesized to lead to a less variant ROA over time.

Table 2-9
OLS of bond rating on an instrument for the prob. of takeover, ITO; and on a Two step estimation of the prob. of takeover, PTO.
(t-statistics in parentheses)

	DEPENDENT VAR = S&P RATING		DEPENDENT VAR = Moody's RATING	
Constant	23.103 (41.40)***	21.162 (25.38)***	22.258 (45.15)***	20.690 (28.95)***
1978-80 Dummy	-0.8780 (-2.72)***		-0.6925 (-2.42)**	
1981-83 Dummy	-0.5508 (-1.95)*	-0.9738 (-3.12)***	-0.4502 (-1.80)*	-0.8472 (-3.05)***
1983-86 Dummy	-0.1057 (-0.40)	-0.9731 (-2.62)***	0.1633 (0.70)	-0.6218 (-1.92)*
ROA	-17.382 (-12.56)***	-16.710 (-10.77)***	-14.270 (-11.35)***	-14.374 (-10.31)***
Log TA	-1.6114 (-21.67)***	-1.4281 (-14.83)***	-1.5890 (-24.41)***	-1.4329 (-17.11)***
ITO	5.8068 (1.78)*		2.8805 (0.99)	
PTO		9.0461 (3.48)***		8.0379 (3.58)***
Adj. R^2	.397	.389	.426	.421
No. Obs.	1141	949	1149	959

*** Denotes significance at the 1 percent level
** Denotes significance at the 5 percent level
* Denotes significance at the 10 percent level

The coefficient on ITO is positive and significant at the 10 percent level in explaining the Standard and Poor's rating, and it is insignificant in explaining the Moody's rating. This evidence is inconclusive regarding endogeneity.[15] However, in the logit estimates on the sample of firms with bond ratings, ITO is never found significant. Hence, ITO may not be a good instrument for PTO.

An alternative measure of PTO is obtained through a two step instrumental variables process. I run the logit model on data from the first sub-period (1978-1980). The resulting coefficients are then multiplied by data from the second time period (1981-1983) and transformed by the logit function to obtain an estimate of the probability of takeover for the second sub-period. This process is repeated using the second and third sub-periods, and the third and fourth sub-periods. The result is an estimate of the probability of takeover for the second, third , and fourth sub-periods.[16] Average bond rating is then regressed on the this estimate of takeover likelihood, PTO. Results are contained in columns two and four of table 2-9.

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[15]I also create a variable equal to one when the bond rating is noninvestment grade and zero otherwise. I then run a logit of with this dummy rating variable on PTO. Similar results to the OLS of bond rating are obtained. The coefficient on ITO is positive and significant at the 10 percent level for Standard and Poor's rating and positive insignificant for Moody's rating.

[16]The first sub-period is eliminated because it would require data from a previous point in time to estimate the logit model of PTO.

Using either Moody's or Standard and Poor's rating, the estimated coefficient on PTO is positive and significant at the 1 percent level.[17] This finding is consistent with the existence of an endogeneity problem where firms with high takeover likelihood increase the amount and risk of their outstanding debt. The implication is that the coinsurance effect may be even stronger than the evidence from the logit estimations suggests.

2.8 Summary and Conclusions

The coinsurance and expropriation hypotheses imply that takeover likelihood is decreasing in risky debt and increasing in safe debt respectively. With a large sample of NYSE/AMEX firms I find evidence consistent with these hypotheses. However, overall this evidence supports the existence of a substantial coinsurance effect while the existence of a significant expropriation effect is not as clear. When leverage is measured using the market value of equity I find that takeover likelihood increases over low leverage levels (safe debt) and decreases over high leverage levels (risky debt). Additionally, I examine the effects of risky debt and safe debt by using debt ratings and combinations of debt ratings and leverage. Again, evidence supporting the

[17]A logit with the dependent variable equal to one for non-investment grade debt and zero other wise renders positive significant at the 5 percent level coefficients on PTO for both Moody's and Standard and Poor's ratings.

coinsurance and expropriation hypotheses results. The evidence supporting the coinsurance hypothesis is extremely strong when debt rating is used; while the evidence regarding the expropriation hypothesis is not as conclusive.

The defensive capability of debt may render measures of risky and safe debt endogenous to takeover likelihood. I find statistical evidence that this defensive role of debt may indeed exist. This finding is argued to upwardly bias the coefficient on bond rating (in the first two columns of table 2-6) away from the negative sign predicted by the expropriation and coinsurance hypotheses. Therefore, the negative significant coefficient found on bond rating (in the first two columns of table 2-6) provides even stronger support of the coinsurance hypothesis.

CHAPTER 3
THE EFFECT OF LEVERAGE ON THE EQUITY PREMIUM PAID IN CASH TENDER OFFERS

3.1 Introduction

Numerous studies document that equityholders earn significant abnormal returns when their firm becomes the target of a tender offer. These studies (Bradley, Desai and Kim, 1988; Huang and Walkling, 1987; Kaufman, 1988; and Stulz, Walkling and Song, 1990) demonstrate that the magnitude of target equity gains resulting from the tender offer depends on ownership structure, competition among bidders, method of payment (cash versus stock), and the proportion of shares sought. However, no prior study has examined the effect of the target firm's capital structure on size of the percentage equity gain.

Assuming the bidder pays the target a fixed premium per dollar of target assets and that no revaluation of the target's outstanding debt or preferred stock occurs (i.e. no synergy gains accrue to nonequity claimants), then the target abnormal equity return (or percentage equity premium) will increase in target leverage (where leverage consists of all claims excluding common equity). This leveraging of the equity premium will be referred to as the leverage effect.

However, the value of target securities other than common equity may change in value around a merger due to the changing value and risk of the assets supporting these claims. If the acquisition causes the debt or preferred securities to become coinsured, then these securities will capture a portion of the synergy gains. If target claimants other than common equityholders gain (lose) than a smaller (larger) portion of the synergy is left to be split amongst the bidder and the target common equityholders. This will lead to a smaller premium paid to target common equityholders.

In addition to this leverage effect, the target's capital structure may affect the equity premium if leverage affects the dollar premium the bidder can afford to pay. For example, Jensen (1986) argues that agency costs decline in leverage thereby increasing firm value. If a portion of the acquisition profit is derived from disciplinary gains, then a more efficient firm will be a less profitable target, ceteris paribus. Therefore, a low levered (inefficient) target firm would have a larger premium than a high levered (efficient) target firm.

I examine the effect of target firms' capital structure on the equity percentage premiums paid in cash tender offers, using a sample of 135 firms receiving cash tender offers between 1980 and 1988. I find evidence consistent with the leverage effect. The percentage premium accruing to target common equityholders increases significantly in target

leverage. I also find evidence that the entire target premium may not be directly passed through to common equityholders. This result is consistent with the idea that the leverage effect is partially impeded by wealth transfers to debt or preferred stakeholders. Put another way, gains to noncommon equity claimants of highly leveraged firms reduce what the bidders are willing to pay target common equityholders. Gains by target claimants other than common equity are investigated as a possible source of this less than perfect pass through, however the evidence is inconclusive. This result may also be due to measurement or specification error.

The remainder of the paper proceeds as follows: Section 3.2 develops a model of target equityholders' percentage premium incorporating leverage's magnification effect and potential wealth transfers between target debtholders and equityholders via expropriation and coinsurance. Section 3.3 summarizes evidence from previous studies. Section 3.4 describes the methodology and data. Section 3.5 presents and interprets the results, and section 3.6 concludes.

3.2 The Leverage Effect

Generally, a bidder pays a premium for the target because the bidder expects to capture synergy gains. The premium paid to the target is a function of the size of the expected synergy gains and the relative bargaining power of the target equityholders. Because the size of the synergy gain is likely

to be proportional to the size of the target, I assume that the premium paid to the target is a percentage of target assets. This percentage is then assumed to depend on firm specific characteristics which capture both the size of the synergy independent of target size and the relative bargaining power of the target equityholders.[1] $\psi(X)$ represents the percentage premium per dollar of target assets, and X is a vector of firm specific attributes which determine the percentage premium paid. Thus, the dollar premium paid to the target, PREM, can be expressed as

$$PREM = \psi(X) * ASSETS \qquad (1)$$

where ASSETS is the dollar value of firm assets.

Dividing both sides of equation (1) by the value of the targets common equity yields:

$$\frac{PREM}{EQUITY} = \psi(X) * \frac{ASSETS}{EQUITY} \qquad (2)$$

where EQUITY is the market value of the common stock prior to an acquisition bid. Equation (2) measures the percentage premium to the target firm's common equityholders provided that common equityholders receive the entire premium. Since the value of assets equals the value of liabilities (debt and preferred claims) plus the value of equity, the common

[1]These firm specific characteristics are discussed and synthesized from the literature review in section 2.3.

equityholders' premium can be expressed as a function of the firm's capital structure:

$$\frac{PREM}{EQUITY} = \psi(X) * \left(\frac{EQUITY}{EQUITY} + \frac{LIAB}{EQUITY}\right)$$

$$= \psi(X) * \left(1 + \frac{LIAB}{EQUITY}\right) \qquad (3)$$

where LIAB is the market value of all liabilities issued by the firm other than common stock. The equity premium is clearly increasing in target leverage, defined as LIAB/EQUITY

Equation (3) assumes that the value of securities other than equity is unaffected by the acquisition may be unrealistic. Expected changes in the value of target debt (or preferred stock) may cause the bidder to decrease or increase the price offered for target shares (see chapter 2 section 2.2). Coinsurance of target debt occurs when the value of the assets supporting the debt increases or when the variance of the assets supporting the debt is reduced. Either or both of these changes are likely to result from an acquisition (Kim and McConnell, 1977; Israel, 1991). If the target debt is coinsured, then less of the total increase in value remains for the target shareholders and the bidder. This leads to a smaller target common equity premium.

By contrast, if the value of the assets supporting the target's outstanding debt decreases or their variance

increases as a result of the acquisition, wealth is expropriated from target debtholders to the bidder and/or target equityholders (Galai and Masulis, 1976).

The existence of such wealth transfers implies that the assumption that debt and preferred stakeholders neither gain nor lose may be inappropriate. Suppose the wealth transfer is a fixed proportion of the dollar value of the takeover premium that comes from liability financed assets. This implies that the wealth transfer as a percentage of equity is equal to

$$\frac{Wealth\ Transfer}{EQUITY} = \psi(X) * \lambda \frac{LIAB}{EQUITY} \qquad (3b)$$

Subtracting equation (3b) from equation (3) to get the target equity premium net of wealth transfers yields equation (4):

$$\frac{PREM}{EQUITY} = \psi(X) * (1 + \frac{LIAB}{EQUITY}) - \psi(X) * (\lambda \frac{LIAB}{EQUITY})$$

$$= \psi(X) * (1 + (1-\lambda) \frac{LIAB}{EQUITY})$$

$$= \psi(X) * (1 + \beta \frac{LIAB}{EQUITY}) \qquad (4)$$

where β equals $(1-\lambda)$.

If the value of debt and preferred securities is unaffected by the merger, the value of β will equal 1, as assumed in equation (3). If debt and preferred stakeholders gain as a result of the acquisition, then β will be less than one. Similarly, if tender offer acquisitions lead to expropriation of debt and preferred stock, then β will be greater than one reflecting the contribution of debt and/or preferred value to the common equityholders' gain. Estimating β will likely improve the estimates of the effect of the X variables which have potentially suffered from misspecification error in previous studies which have implicitly assumed β equals zero.

3.3 Existing Evidence on Target Abnormal Returns

A number of empirical studies examine the determinants of the percentage abnormal returns to target common stock resulting from an acquisition bid. A survey of these studies is provided below. I control for the variables found to be significant determinants in these studies.

3.3.1 Acknowledged Determinants of Target Abnormal Returns

Huang and Walkling (1987) examine target abnormal equity returns at the time of an initial acquisition announcement for a sample of 204 acquisition announcements during the period 1977-1982. They include both merger offers and tender offers. Their primary result is that the method of the bidder's

payment significantly impacts the abnormal return. Specifically, they find that cash offers are associated with statistically larger abnormal returns than stock offers.

Bradley, Desai and Kim (1988) examine target equity abnormal returns for a sample of 236 tender offers during the period 1963-1984. They find that target abnormal returns are larger in takeover contests involving multiple bidders as opposed to a single bidder. Additionally, they find that the abnormal return increases in the fraction of target shares sought by the bidder. They note that this is consistent with an upward sloping supply curve for target shares.[2] They also note that target abnormal returns are significantly larger after the passage of the Williams Act in 1968.[3]

Stulz, Walkling and Song (1990) examine the impact of target ownership structure on the equity abnormal returns associated with a sample of 104 tender offers during the period 1968-1986. They argue that the differential control benefits coupled with tax implications of large block holders alters the blockholders' incentives to tender. These incentives affect the slope of the supply of shares available to the bidder.

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[2]Alternatively, Bagnoli and Lipman (1988) argue that the percentage of shares sought in a tender offer conveys private information about the value of the target's shares.

[3]The Williams Act of 1968 forced bidding firms to provide detailed information on the financing of the acquisition as well as details of the intended reorganization of the target. This result is also consistent with evidence originally presented by Jarrell and Bradley (1980).

Potential large blockholders include institutional investors, target management, and the bidding firm. Institutional investors are conjectured to tender at a low price because of their low capital gains tax rate.[4] They find that institutional holdings statistically decrease the target abnormal equity return. Because managers will tender their shares only if they are compensated for their forgone control benefits, more substantial management holdings are thought to increase the abnormal return. Finally the bidding firm's initial stake will decrease the number of new shares necessary for a successful acquisition, and hence the premium required to obtain control.

For their sample with multiple bidders Stulz, Walkling and Song find that the premium indeed increases in management holdings.[5] Additionally, the bidder's percent of shares owned prior to the tender offer significantly decreases the target bnormal return.

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[4]Brown and Ryngaert (1992) illustrate that the institutional investors indeed decrease the slope of the supply curve of target shares available to the bidder.

[5]Morck, Schleifer and Vishny (1988) argue multiple bidder offers are more likely to be for disciplinary gains because the source of the synergy gain is not unique to a single bidder. The existence of disciplinary gains may imply that the managers control benefit contains significant perquisite consumption.

3.3.2 Relation Between Target Abnormal Returns and Leverage

I am aware of only one previous study which includes target leverage as a determinant of the target equity premium. Kaufman (1988) includes a long term debt to market value of equity variable in an attempt to explain target abnormal returns for a sample of 748 acquisition bids during the period 1964-1983. He finds no significant relation between target abnormal returns and the debt to equity ratio. However, this relatively simple treatment suffers from several shortcomings. First, long term target debt is only a one part of a firm's liabilities. For instance, short term debt and preferred stock act to lever the common equity merger premium.

Second, Kaufman simply includes leverage as a linear term rather than the nonlinear specification suggested by equation (4). For instance, a tender offer involving multiple bids may result in a larger dollar premium paid to target shareholders. If the firm is also highly levered, this would result in an even larger percentage premium paid. My specification, equation (4), uses a broader definition of leverage (which includes preferred stock and short term debt) and incorporates leverage's nonlinear effect.

3.4 Methodology and Data

Equation (4) from Section 3.2 can be estimated using nonlinear least squares in the following cross sectional regression:

$$\left(\frac{PREM}{EQUITY}\right)_j = \Psi(X_j) * \left(1 + \beta\left(\frac{LIAB}{EQUITY}\right)_j\right) + \varepsilon_j \qquad (5)$$

In the cross sectional estimation of equation (5), β measures the effect of the average wealth transfer. The potential for coinsurance and expropriation is likely to be correlated with leverage. High leverage firms are likely to have riskier debt making coinsurance more probable, while low leverage firms are likely to have safer debt making expropriation more probable.[6] Relative to the case of no wealth transfers, this would tend to increase the target equity premium for low levered firms and decrease the target equity premium for high levered firms. The net result should be a value of β less than one.

In summary, the value of β may differ from one because of the potential for debtholder and preferred stockholder gains and losses (to the benefit or at the expense of target common equityholders). Although the value of β relative to one is of interest, the primary concern is determining whether β is significantly different from zero, as the previous studies have implicitly assumed.

A sample of tender offers was collected from a printout of tender offers supplied by the U.S. Securities and Exchange Commission for the period 1981-1988. In an effort to create

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[6]See Chapter 2 section 2.2 for more detailed discussion.

a homogeneous sample, tender offers included in this study must meet the following criteria to be included in the sample:

(1) The tender offer was for cash and provided for the purchase of all shares either directly through the tender offer or through a firm commitment to buy the remaining shares in a merger transaction.

(2) The target had to be listed on the New York or American Stock Exchange and its stock returns had to be available on the Center for Research in Security Prices return tapes on the date of the offer announcement.

(3) The target was followed by the Value Line Investment Survey. Value Line carries a number of data items needed for the tests conducted in this chapter.

(4) The target was not a finance company. Finance companies are excluded because their leverage and asset structure is drastically different from typical industrial firms.

(5) No more than 200 trading days existed between the date the market discovers that the target is an acquisition candidate and the final tender offer. This eliminates firms with long drawn out acquisition events. In these cases, the estimates of premiums are very noisy.

(6) The bidder is a publicly traded domestic corporation. This eliminates acquisitions by leveraged buyout firms, limited partnerships, and foreign acquirers. Again, this is done to yield a relatively uniform sample of target firms.[7]

The result is a sample of 135 tender offers. The next task is to get an unbiased measure of the takeover premium. This requires that any increases in target price due to information leaked about a pending tender offer be incorporated. Jarrell and Poulsen (1989) report that there are frequent news stories hinting at an impending takeover bid prior to a formal tender offer and that the target abnormal return recorded at the tender offer date tends to be lower when there are prior news stories. Jarrell and Poulsen also report considerable run-up in target returns in the twenty days prior to a formal tender offer.

The Dow Jones News Retrieval Service was used to search for previous newswire stories about the target and locate the first announcement of any corporate control event involving the target firm. A corporate control event is defined as one of the following:

1. An announcement that the firm received a takeover bid.

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[7]The tax treatment of the excluded acquisitions may vary considerably from the ones examined. Furthermore, many buyouts by private firms may be, in part, motivated by a desire to change the target's capital structure.

2. An announcement that an entity unaffiliated with the firm had purchased a stake or increased a stake in the company's stock.

3. An announcement that the firm was in merger talks, was seeking to be acquired, or was seeking to sell off operations consisting of at least one third of firm sales.

4. An announcement of any rumor that the firm was an acquisition target, unless the rumor was denied as false by the parties involved.

5. An announcement of unusual target price increases in the month preceding any of the above mentioned events.

In this chapter, a rolling five month window was used to search for corporate control events.[8] The five months prior to the initial tender offer announcement are searched for any such events. If an event was found then the five months prior to the discovered event are searched. The process continued until no events were found in a prior five month window.

Frequently, the initial tender offer is not the last. Dow Jones was also used to find the final announcement date of

[8]A five month window is searched to insure any price run-up due to market expectations of a control event are included. A shorter window may increase the precision of the premium estimates, but may leave out an important portion of the premium (in the form of price run-up)

the final successful offer for the target firm. The window for estimating the target's abnormal equity return is twenty trading days before the first corporate control event announcement to five trading days after the announcement of the final offer.

To get an estimate of the target equity abnormal return during the event window, I construct a modified market model from 300 to 60 days prior to the first corporate control announcement event where the return generating process is assumed to be

$$R_{j,t} = \alpha_{j,1} + \alpha_{j,2} R_{m,t} + \alpha_{j,3} R_{m,t-1} + e_j \qquad (6)$$

Where $R_{j,t}$ is the return to firm j at time t, $R_{m,t}$ is the CRSP Value Weighted Market return, and the α's are firm specific parameters to be estimated. The resulting slope coefficients from the market model are used as estimates of the target's sensitivities to the market return and the lagged market return.

To calculate the expected return during the event window, I assume that the return generating process as defined by equation (6) holds. The abnormal return from 20 days prior to the initial offer to 5 days following the successful offer is calculated as follows:

$$ARET_j = \frac{\prod_{t=n-20}^{N+5} (1+R_{j,t})}{\prod_{t=n-20}^{N+5} (1+\hat{\alpha}_{j,1}+\hat{\alpha}_{j,2}R_{m,t}+\hat{\alpha}_{j,3}R_{m,t-1})} - 1 \qquad (7)$$

where $R_{j,t}$ is the return to firm i on day t; $R_{m,t}$ is the return to the value weighted market portfolio on day t; and the α's are the firm specific parameters from the return generating process defined in equation (6). N is the announcement day of the final offer while n is the announcement day of the initial corporate control activity.

This cumulative abnormal return measure is then adjusted for market expectations of future bids. The abnormal return may reflect the market's expectations of additional higher bids or expectations regarding the potential failure of the final bid.[9] However with hindsight we know there were no additional bids and that all final bids were successful. To adjust the abnormal return so it reflects the true final premium paid to the target equityholders any expectation about further offers or about the success of this final offer must to be removed. Therefore the cumulative abnormal return is multiplied by the total offer price divided by the price 5 days after the final bid. The total offer price ($TotPrc_i$)

[9]For instance, in the case of the acquisition of Gulf Corp. by Chevron there was some question as to whether the Congress would allow the acquisition to take place. Therefore, the stock sold at a substantial discount relative to the tender offer price.

equals the tender offer price times the proportion of shares sought plus the back-end price times the remaining percentage of shares not sought in the tender offer. The back-end price is the price of the target stock ten trading days after the tender offer expired:

$$ARET_{adj,i} = (1+ARET_i)\frac{TotPrc_i}{P_{i,N+5}}-1 \qquad (8)$$

where $TotPrc_i$ is the total offer price and $P_{i,N+5}$ is the price of firm i five days after the announcement day of the final offer. The abnormal return as defined by equation (8) is used as the dependent variable in estimating equation (5).

One potential problem in estimating equation (5) is that the disturbance term may be heteroskedastic. Both the variance of daily returns and the number of daily abnormal returns used in estimating the target's aggregate abnormal return differ across firms. Therefore the variance of the aggregate abnormal return will be observation specific. To help alleviate the potential heteroskedasticity equation (5) is estimated using weighted nonlinear least squares. The weight used is equal to the inverse of the estimated standard deviation of the aggregate abnormal return. The weight is equal to the standard deviation of the market model regression (a one day standard deviation) multiplied by the square root

of the number of days in the tender offer window (to get an N day standard deviation).[10]

The next task in estimating equation (5) is to specify the vector of attributes, X, which affect the size of the percentage premium paid per dollar of operating assets. These could be variables that proxy for the level of potential synergies from an acquisition or variables that proxy for the portion of synergy gains that will accrue to the target firm security holders.

The previous empirical literature on determinants of tender offer premia is used to collect variables to model $\psi(X)$. These variables include a measure of insider holdings similar to that used in Stulz, Walkling, and Song (1990). Insider holdings of common stock is taken from Value Line Investment Survey on the date closes and prior to the initial corporate control announcement date. Presumably, when insiders own a larger proportion of the firm, they also have more bargaining power over acquisition terms. However, going from 40% to 50% insider holding probably has less impact than going from zero to 10%. At 40% management can arguably block most any bid with little effort and increasing their holdings will trivially impact their bargaining power. Arguably, any increment to insider holdings above 50% does not increase

[10]This estimate of the variance of the equity percentage premium is actually the variance of the cumulative abnormal return when the individual abnormal returns are summed. However, the variance of the product of these abnormal returns should be highly correlated with this measure.

bargaining power because voting control has been obtained. I use the square root of the minimum of 50% and insider holdings reported by Value Line.[11] Similarly, the square root of the percentage of stock held by institutions reported in the S&P Stock Guide, and the square root of the bidder's stock holdings in the target reported in the Securities and Exchange Commission filings are used as explanatory variables. The percent of shares sought in the offer is also included as an explanatory variable. Because the supply of target shares is assumed to be upward sloping, a greater percentage of shares sought should raise the price required for a successful offer, thereby raising the target equity premium.

Consistent with Bradley, Desai and Kim (1988), I include whether the target was sought by multiple bidders as a determinant of the percentage premium per dollar of target assets. A "multiple bid" situation occurs if the Dow Jones News Search revealed that more than one identifiable party made an offer to acquire the target firm. This includes LBO bids from management groups and recapitalization plans resembling LBO's that are proposed by management as an alternative to a takeover bid.

Within this sample of 135 cash tender offers 7 targets are regulated firms. Regulators may impose restrictions on the reorganization of the target which could limit the

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[11]Stulz, Walkling and Song (1990) use the square root of these measures, but they do not truncate insider holdings at 50%.

acquisition gains and in turn reduce the target common equity premium. Additionally, through output and service pricing control regulators may pass a portion of the acquisition gains to consumers, again with the effect of reducing the target common equityholders premium. Therefore to control for regulated firms I include a dummy variable, DREG, equal to one for regulated firms. I also perform all estimations for the sub-sample of firms which excludes regulated firms.

Details on the target firm's capital structure are collected from Value Line. Value Line provides quarterly data on current assets, inventory, current liabilities, long term debt, shares outstanding, and the liquidating value of preferred stock. Further, Value Line provides detailed information on the convertibility of debt and preferred securities. When a 10-K report is filed between the Value line information date and the initial announcement date the figures from the 10-K report are used in place of Value Line information.

The market value of equity is calculated by taking the shares outstanding reported in Value Line or the 10-K reports and multiplying by the share price of the target's stock 21 days prior to the first corporate control event. All figures are adjusted for any stock splits or new equity issues that may occur between the Value Line date and 21 days prior to the first corporate control announcement.

Although in theory leverage refers to debt securities, many liabilities can be viewed as leverage. For the purposes of this analysis, leverage consists of all securities which have no control value to the bidder. In general, all claims other than common stock constitute a liability and contribute to leverage. For robustness I use two different measures of leverage, LIAB in equation (5). The first measure is the sum of the book value of long term and short term debt plus the liquidating value of preferred stock divided by the market value of equity (measured 21 days prior to the first control event). This measure excludes liabilities such as accounts payable and is a traditional leverage measure. The second measure incorporates current liabilities and the existence of financial assets. This measure is equal to the sum of the book value of long term debt and current liabilities plus the liquidating value of preferred stock all minus financial assets (financial assets is measured as current assets less inventory and consists of cash, accounts receivable and marketable securities).

To obtain an accurate measure of firm financial structure, the market value of equity is adjusted by assuming that all convertible securities that are in the money 21 days prior to the first control event are effectively converted. These "converted" shares are included in shares outstanding. Additionally, effectively converted debt and preferred stock is subtracted from the reported liabilities.

Financial assets are subtracted out of leverage because they may cause a firm's leverage to be overstated. The leverage effect implies that debt financing passes the portion of the synergy gains from debt financed assets along to equityholders. The more levered a firm becomes the greater the pass through and the greater the equityholders conjectured premium. However, if an all equity firm issues debt and uses the proceeds to purchase marketable securities or simply holds the cash, it is not clear that the firm has actually increased its leverage in the context of this study.

Direct evidence of coinsurance or expropriation is obtained from publicly traded debt or preferred securities agency ratings changes. The ratings changes were identified from the Dow Jones News Retrieval service and the Standard & Poor's Creditwatch publication. Standard and Poor's rated issues from 54 of the target firms. The rating prior to the tender announcement is compared with the ratings in the six months following the final offer. Of the 54 firms followed by Standard and Poor's 14 firms experienced upgrades attributed to the acquisition, 29 experienced downgrades attributed to the acquisition, and 11 had no change in their ratings. These issues consisted of 43 investment grade issues and 11 noninvestment grade issues, prior to any corporate control activity. Of the investment grade issues 8 were upgraded while 26 were down graded. Similarly, the noninvestment grade issues experienced 6 upgrades and only 3 downgrades. This is

evidence consistent with riskier debt being more susceptible to coinsurance and safer debt more likely to suffer from expropriation. Summary statistics of the data are contained in table 3-1.

Table 3-1
Summary Statistics

Variable	Mean	Std. Dev.	No. Obs.
Equity abnormal return	.6313	.3544	135
Lev1[a]	.5973	.7249	135
Lev2[b]	.4152	.8513	135
Conv. securities to eq.	.0620	.1675	135
Insider holdings	.1340	.1543	135
Institutional holdings	.3830	.1868	135
Acquirer's foothold	.0300	.0604	135
% with multiple bidders	42.22%		135
% Regulated: DREG	5.19%		135
% with S&P upgrade	25.93%		54
% with S&P downgrade	50.70%		54

[a]Lev1 is leverage measure as the sum of debt and the liquidating value of preferred stock divided by the market value of equity.

[b]Lev2 is the same as Lev1 except the numerator includes all current liabilities and the numerator is net of financial assets (current assets less inventory).

3.5 Results

For comparison with previous studies weighted least squares of the target equity premium on firm characteristics is performed (where the weight is the standard deviation of the cumulative abnormal return). The first column of table 3-2 contains results of the measured target equity premium regressed against the inside holdings measure, the institutional holdings measure, the bidder's foot hold, the percent of shares sought, whether multiple bidders were present, and DREG. With the exception of insider holdings, the results are consistent with previous studies. However, the target equity premium statistically decreases as insider holdings increase, in contrast with the positive relationship found by Stulz, Song, and Walkling (1990). This may be due to differences in the two samples.[12]

The regressions in the second and third columns of table 3-2 include the leverage ratio measured as Lev1. The first column contains a regression of the premium on a constant and the leverage measure Lev1 while the third column includes Lev1 in addition to the control variables. The results indicate a positive statistically significant relationship between the target firm's capital structure and its equity premium.

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[12]The sample in Stulz, Song and Walkling (1990) consists of tender offers from 1968-1986. Further, their sample includes both stock and cash offers.

Table 3-2
Weighted least squares of the target abnormal equity return for the sample of 135 cash tender offers.
(t-statistics are in parentheses)

Constant	.5831 (3.55)***	.3870 (12.33)***	.3381 (1.95)*
Insider holdings	-.6193 (-4.11)***		-.4888 (-3.27)***
Institutional holdings	-.3210 (-1.69)*		-.0525 (-.26)
Bidder foothold	-.1941 (-.87)		-.1786 (-.83)
% of shares sought	.3000 (2.43)**		.2747 (2.31)**
Mult. Bidders	.1108 (2.43)**		.0840 (1.73)*
DREG	-.0372 (-.37)		-.1967 (-1.82)*
Lev1 : (Debt+Pfd.) to equity		.2407 (4.72)***	.1842 (3.41)***
Adj. R^2	.009	0.065	.085

*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

Table 3-3
Weighted least squares of the target abnormal equity return for the sample of 135 cash tender offers.
(t-statistics are in parentheses)

Constant	.5831 (3.55)***	.4477 (18.71)***	.3122 (1.96)*
Insider holdings	-.6193 (-4.11)***		-.4305 (-3.02)***
Institutional holdings	-.3210 (-1.69)*		-.0440 (-.24)
Bidder foothold	-.1941 (-.87)		-.2356 (-1.15)
% of shares sought	.3000 (2.43)**		.3162 (2.81)***
Mult. Bidders	.1108 (2.43)**		.1153 (2.53)**
DREG	-.0372 (-.37)		-.2742 (-2.64)***
Lev2 : (Debt+CL+Pfd.-FA) to equity		.2224 (5.63)***	.2089 (5.13)***
Adj. R^2	.009	0.064	.173

*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

This relationship between target leverage and premium may be the result of correlation between capital structure and the other omitted control variables. Therefore, the final linear specifications include both the control variables and the capital structure variable. This specification is contained in the last column of table 3-2. Again, a positive significant at the 1% level coefficient results for both leverage measures implying their impact is not simply due to correlation with these other determinants.

The results are virtually identical when the leverage measure incorporates financial assets and all current liabilities, Lev2. The primary difference is that the leverage measure including all current liabilities and net of financial assets, Lev2, is more significant and leads to a more significant overall regression. These results are contained in table 3-3.

Although these linear specifications provide evidence of a significant relationship between leverage and the target equity premium, the model in equation (4) implies a nonlinear specification. Estimates of various specifications of equation (5), the nonlinear specification, are contained in tables 2-4 and 2-5. These specifications assume that the percentage premium per dollar of target asset, $\psi(X)$, is a linear function of the measures of insider holdings, institutional holdings, the bidder's foothold, the percent of shares sought, and whether there were multiple bidders.

The first column of tables 2-4 and 2-5 contain the basic specification for Lev1 and Lev2 respectively. In both instances the coefficient on leverage is statistically positive at the 1% level indicating that prior studies, implicitly assuming the coefficient on the leverage term equals zero, may suffer from misspecification. With regard to the size of the coefficients relative to a value of one, the coefficient on Lev1 is not statistically different from one at the 10% level. The coefficient on Lev2, however, is statistically less than one at the 1% level.[13] This deviation could simply be due to specification or measurement error.[14]

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[13]Also of note is the change in both the size and significance of the coefficient on multiple bidders depending on the leverage measure used. When Lev1 is included the coefficient is approximately twice as large as that which results when Lev2 is included. Similarly the significance of multiple bidders is much greater for specifications including Lev2 as opposed to Lev1.

[14]Specification error is, as always, a potential problem. The methodology in this study may be particularly susceptible to specification error stemming from heteroskedasticity. If the percentage premium per dollar of assets is measured with error then the error term in equation (5) is correlated with leverage:

$$\left(\frac{PREM}{EQUITY}\right)_j = \Psi(X_j + \xi_j) * \left(1 + \left(\frac{LIAB}{EQUITY}\right)_j\right) + \varepsilon_j$$

Regrouping terms implies:

$$\left(\frac{PREM}{EQUITY}\right)_j = \Psi(X_j) * \left(1 + \left(\frac{LIAB}{EQUITY}\right)_j\right) + \xi_j\left(1 + \beta\left(\frac{LIAB}{EQUITY}\right)_j\right) + \varepsilon_j$$

To test for heteroskedasticity of this form the data is sorted by the leverage and the model is re-estimated. A Durbin-Watson statistic is calculated to test for autocorrelation. If heteroskedasticity exists from correlation between the error term and leverage this approach of sorting by leverage should lead to the finding of autocorrelation. None of the estimations result in the

A potential cause of the coefficient's difference from one is the existence of wealth transfers. If coinsurance is prevalent then the pass-through of the premium to equityholders will be less than perfect and a coefficient less than one would result. An additional reason for $\beta<1$ may be the existence of convertible securities. Although the leverage and equity measures are adjusted for convertible securities in the money prior to the initial announcement, the remaining convertibles will experience changes in their option value due to the changes in the target firm's equity price. Because the option value of the convertible security increases as the share price increases, one would expect the convertible securities are likely to capture a portion of the premium.

To test for the effect of convertible securities, the ratio of convertible debt plus convertible preferred stock to equity is included in addition to the other ratios in equation (5):

$$\left(\frac{PREM}{EQUITY}\right)_j=\psi(X_j)*\left(1+\beta_1\left(\frac{LIAB}{EQUITY}\right)_j+\beta_2\left(\frac{CONVERTIBLES}{EQUITY}\right)_j\right)+\varepsilon_j \quad (9)$$

If convertible securities are contain the majority of wealth transfers, then β_1 will become closer to one and β_2, which measures the marginal effect of convertible securities, will be negative. Column 2 of tables 2-4 and 2-5 contain the

---

rejection of the null hypothesis of no autocorrelation.

results from this estimation for Lev1 and Lev2 respectively. The estimated coefficient on the convertible ratio is negative but insignificantly different from zero at the 5% level. In these two estimations the coefficients on Lev1 and Lev2 rise in value. The coefficient on Lev1 increase from .6358 to .9665 and is statistically undistinguishable from one. The coefficient on Lev2 increases from .6858 to .7214 but is statistically less than one at the 5% level.

Another possible explanation for the leverage ratio coefficient being less than one is that nonconvertible securities gain from the merger. Thus I control for changes in value of publicly traded debt and preferred stock of the target as proxied by agency ratings changes. I assume that an upgrade is associated with debt and preferred holder gains and that downgrades are associated with debt and preferred holder losses.

The size of the coinsurance or expropriation effect on the equity premium should depend on the target's level of debt and preferred stock in addition to the direction of the rating change. Therefore the ratio of long term debt plus preferred to equity interacted with the upgrade and downgrade dummy variables are included in equation (5):

$$ABRET_j = \psi(X_j) * (1 + \beta(\frac{LIAB}{EQUITY})_j$$

$$+\lambda_1 UPGRD * \frac{LIAB}{EQUITY}_i + \lambda_2 DNGRD * \frac{LIAB}{EQUITY}_i) + \varepsilon_i \qquad (10)$$

Current liabilities are excluded from the interaction because they are less likely to change as a result of the merger.

The third column of tables 2-4 and 2-5 report the results from this estimation for Lev1 and Lev2 respectively. If changes in the value of liabilities influences the premium paid to equity, then negative and positive coefficients are expected on the interactive upgrade and downgrade terms respectively. For the estimation using Lev1 for leverage, the coefficient corresponding to an upgrade is positive and insignificantly different from zero while the coefficient corresponding to a down grade is negative and insignificantly different from zero.[15] This evidence fails to support the implications of coinsurance and expropriation. Of note however is the dramatic change in size and significance of the other coefficients from their previous levels. This may be because of the small sample size in this estimation, 59.

With Lev2 as the leverage term the results differ only in that the coefficient on the upgrade term is of the predicted sign, negative. However, the small sample size again renders little statistical power to this estimation. Even with a sufficiently large sample, additional problems with using upgrades and downgrades may exist. The rating change proxies for the overall profitability (and therefore the premium paid) of the acquisition. Similarly, an upgrade may proxy for a

[15]The test including current liabilities in the interactive rating change terms renders similar coefficients and significance levels.

Table 3-4
Weighted nonlinear least squares estimation of equation (5) using Lev1 as the leverage measure.
(t-statistics are in parentheses)

$$(5)\quad \left(\frac{PREM}{EQUITY}\right)_i = (\alpha X_i) * (1+\beta \left(\frac{LIAB}{EQUITY}\right)_i) + \varepsilon_i$$

Constant	.2562 (1.94)*	.1953 (1.69)*	.4438 (1.56)
Insider holdings	-.3039 (-2.45)**	-.2695 (-2.37)**	-.5482 (-2.12)**
Institutional holdings	-.0699 (-.51)	.1423 (1.27)	-.0523 (-.14)
Bidder foothold	-.1240 (-.77)	-.1177 (-.81)	-.2559 (-.67)
% of shares sought	.2001 (2.14)**	.1877 (2.17)**	.1821 (1.15)
Mult. Bidders	.0537 (1.43)	.0374 (1.10)	.0564 (.75)
DREG	-.1914 (-3.38)***	-.2141 (3.07)***	-.0461 (-.35)
Lev1 : (Debt+Pfd.) to equity	.6358 (2.72)***	.9665 (3.07)***	.1500 (.41)
Upgrade*Lev1			.0143 (.07)
Downgrade*Lev1			-.0348 (-.18)
Convertible Dbt+Pfd to eq.		-1.039 (-1.86)*	
Adj. R^2	.073	.091	-.181
Num. of Obs.	135	135	59[a]

[a]In addition to the 54 targets found to have publicly traded debt or preferred securities followed by Standard & Poor's, 5 all equity firms are included. These firms are categorized as experiencing neither upgrades nor downgrades.

*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

Table 3-5
Weighted nonlinear least squares estimation of equation (5)
using Lev2 as the leverage measure.
(t-statistics are in parentheses)

$$(5)\quad \left(\frac{PREM}{EQUITY}\right)_i = (\alpha X_i) * \left(1+\beta\left(\frac{LIAB}{EQUITY}\right)_i\right) + \varepsilon_i$$

Constant	.1285 (1.10)	.1238 (1.05)	.0235 (.13)
Insider holdings	-.2207 (-1.91)**	-.2244 (-1.91)*	-.0949 (-.55)
Institutional holdings	.2035 (1.69)*	.2181 (1.83)*	.3448 (1.67)
Bidder foothold	-.2008 (-1.26)	-.2053 (-1.28)	-.4556 (-1.83)*
% of shares sought	.2656 (2.96)***	.2697 (2.97)***	.2325 (2.07)**
Mult. Bidders	.1148 (3.02)***	.1180 (3.07)***	.1018 (1.90)*
DREG	-.2539 (-4.87)***	-.2683 (-5.16)***	-.1472 (-2.08)**
Lev2 : (Debt+CL+Pfd.-FA) to equity	.6858 (5.78)***	.7214 (6.04)***	.8811 (4.62)***
Upgrade*Lev2			-.2129 (-1.32)
Downgrade*Lev2			-.0848 (-.54)
Convertible Dbt+Pfd to eq.		-.5092 (-1.43)	
Adj. R^2	.206	.211	.077
Num. of Obs.	135	135	59[a]

[a]In addition to the 54 targets found to have publicly traded debt or preferred securities followed by Standard & Poor's, 5 all equity firms are included. These firms are categorized as experiencing neither upgrades nor downgrades.

*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

very profitable acquisition in addition to coinsurance. If the upgrades and downgrades are based at least in part on the quality of the acquisition, then the coefficients on these interactive terms will shift in direction away from supporting the coinsurance and expropriation hypotheses.

To insure the results are not driven by the inclusion of regulated firms, tables 2-6 and 2-7 replicate tables 2-4 and 2-5 for the sub-sample of firms which do not include regulated firms. The primary reason for this is that regulated firms tend to be highly levered and if DREG does not adequately control for the difference between regulated and unregulated firms, then the effect of leverage may also proxy for the effect of regulation. The results are extremely similar to those in which the regulated firms are included. The coefficient on leverage could be less than one because a firm's capital structure is correlated with the size of potential acquisition gains. Jensen (1986) argues that manager's of firms rich in free cash flow have an incentive to suboptimally invest. Because debt bonds managers to pay out cash flow, highly levered firms are less likely to suboptimally invest than less levered firms. If the takeover gain stems from the elimination of suboptimal investment than highly levered firms will have smaller takeover gains than less levered firms. This implies that leverage should be a control variable as a determinant in $\psi(X)$ of equation (5).

Table 3-6
Weighted nonlinear least squares estimation of equation (5)
using Lev1 as the leverage measure
and excluding regulated firms.
(t-statistics are in parentheses)

$$(5)\quad \left(\frac{PREM}{EQUITY}\right)_i = (\alpha X_i) * \left(1+\beta\left(\frac{LIAB}{EQUITY}\right)_i\right) + \varepsilon_i$$

Constant	.2566 (1.98)**	.2103 (1.81)*	.3806 (1.41)
Insider holdings	-.3070 (-2.54)**	-.2975 (-2.57)**	-.5039 (-1.92)*
Institutional holdings	-.0065 (-.04)	.0444 (.35)	-.0012 (-.00)
Bidder foothold	-.1412 (-.87)	-.1538 (-1.00)	-.4073 (-1.20)
% of shares sought	.2292 (2.44)**	.2271 (2.52)**	.1703 (1.18)
Mult. Bidders	.0761 (1.95)*	.0629 (1.58)*	.0616 (.82)
Lev1 : (Debt+Pfd.) to equity	.7381 (2.95)***	.9822 (3.14)***	.5135 (.88)
Upgrade*Lev1			.1931 (.81)
Downgrade*Lev1			-.2386 (-1.03)
Convertible Dbt+Pfd to eq.		-1.070 (-1.92)*	
Adj. R^2	.107	.130	-.101
Num. of Obs.	128	128	52

*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

Table 3-7
Weighted nonlinear least squares estimation of equation (5)
using Lev2 as the leverage measure
and excluding regulated firms.
(t-statistics are in parentheses)

$$(5)\quad \left(\frac{PREM}{EQUITY}\right)_i = (\alpha X_i) * \left(1+\beta\left(\frac{LIAB}{EQUITY}\right)_i\right) + \varepsilon_i$$

Constant	.1427 (1.24)	.1400 (1.21)	-.0086 (-.04)
Insider holdings	-.2344 (-2.08)**	-.2394 (-2.09)**	-.0504 (-.26)
Institutional holdings	.0859 (.69)	.0966 (.78)	.3500 (1.28)
Bidder foothold	-.2591 (-1.60)	-.2717 (-1.66)*	-.7320 (-2.57)**
% of shares sought	.3123 (3.43)***	.3175 (3.44)***	.2403 (2.02)**
Mult. Bidders	.1639 (4.04)***	.1718 (4.15)***	.1480 (2.57)**
Lev2 : (Debt+CL+Pfd.-FA) to equity	.7450 (6.45)***	.7823 (6.80)***	.9764 (5.06)***
Upgrade*Lev2			-.1335 (-.66)
Downgrade*Lev2			-.1626 (-.89)
Convertible Dbt+Pfd to eq.		-.6064 (-1.73)*	
Adj. R^2	.271	.282	.209
Num. of Obs.	128	128	52

*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

Table 3-8 contains results from the estimation of equation (5) with leverage included as a variable in $\psi(X)$.

One problem in including leverage in $\psi(X)$ is that the function for which the sum of squared errors is minimized becomes more complicated. The computer algorithm which searches for the minimum sum of squared errors may mistake a local minimum for a global minimum. Therefore, the results depend quite heavily on starting values. The results reported used starting values from estimating equation (5) without the leverage term included in $\psi(X)$. These starting values are chosen because they yield the smallest sum of squared errors found which are more likely to be associated with the global minimum.

Results from estimating equation (5) with leverage included in the $\psi(X)$ term are contained in table 3-8. For the entire sample and for the sub-sample of unregulated firms with leverage measured as Lev2, the coefficient on leverage included in $\psi(X)$ is negative, consistent with Jensen (1986), but insignificantly different from zero. With the sub-sample excluding regulated firms and leverage measured as Lev1 the results are peculiar. The leverage term in $\psi(X)$ has a positive statistically significant coefficient while the coefficient on leverage measuring the leverage effect is negative and insignificant. This is quite puzzling and may be due to the collinearity imposed and the complexity of the function. Additionally, this result appears regardless of

Table 3-8
Weighted nonlinear least squares estimation of equation (5)
for both the aggregate sample and
the sub-sample excluding regulated firms.
(t-statistics are in parentheses)

$$(5)\quad \left(\frac{PREM}{EQUITY}\right)_i = (\alpha X_i) * (1+\beta\left(\frac{LIAB}{EQUITY}\right)_i) + \varepsilon_i$$

	Whole Sample and Lev1	Whole Sample and Lev2	Unreg. firms and Lev1	Unreg. firms and Lev2
Constant	.2493 (1.98)*	.1622 (1.44)	.2902 (1.47)	.1587 (1.42)
Insider holdings	-.2817 (-2.32)**	-.1767 (-1.61)	-.4751 (-3.13)***	-.1973 (-1.78)*
Inst. holdings	.0639 (.46)	.1089 (.87)	-.0577 (-.28)	.0378 (.29)
Bidder foothold	-.1217 (-.79)	-.2490 (-1.64)	-.2049 (-.93)	-.3041 (-1.89)*
% of shrs sought	.1967 (2.18)**	.2877 (3.35)***	.3095 (2.50)**	.3238 (3.65)***
Mult. bidders	.0501 (1.37)	.1131 (3.14)***	.0898 (1.78)*	.1600 (3.99)***
DREG	-.1831 (-3.06)***	-.2254 (-4.56)***		
Lev1 in $\psi(X)$	-.0102 (-.37)		.3033 (2.29)**	
Lev1	.7521 (2.06)**		-.0305 (-.35)	
Lev2 in $\psi(X)$		-.0314 (-1.94)*		-.0220 (-1.29)
Lev2		.8662 (5.94)***		.8670 (5.96)***
Adj. R^2	.0662	.218	.118	.273
Num. of Obs.	135	135	128	128

*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

starting values for this particular specification. However, the results using Lev2 are consistent with Jensen and robust for both the full and sub samples.

3.6 Conclusion

For a sample of 135 cash tender offers the relationship between the target's equity premium and leverage is investigated. I expect that the equity premium will be increasing in leverage because the debt securities are generally not purchased by the bidding firm, and the entire target firm premium is paid to the common equityholders. I indeed find that the target abnormal equity return is increasing in target leverage consistent with the leverage effect. Further this result is robust across various specifications and robust to the two different leverage measures used.

Although not directly paid for their claims debtholders and preferred stockholders may find that wealth transfers from coinsurance or expropriation may affect the value of their claims. Such wealth transfers may diminish or enhance the leveraging of the equity premium. I conjecture that convertible securities are more likely to gain in a merger, and therefore, separate out their effect from leverage. I find weak evidence that these securities reduce the target equity premium. Additionally, I attempt to examine the impact of wealth transfers; however by using Standard and Poor's

upgrades of target debt or preferred stock to proxy for coinsurance and downgrades to proxy for expropriation. Again the results are inconclusive.

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APPENDIX

The logit model used to relate the probability of takeover and its hypothesized determinants requires careful interpretation. It is shown below that the sign of the coefficient that results indeed implies the direction of the impact of the exogenous variable on the probability. Below, the direction of the impact of an exogenous variable is shown to be consistent with the sign of the estimated coefficient.

The probability of takeover is related to explanatory variables through the following logit model:

$$P_i = \frac{e^{f(Lev_i,\theta)+x_i'\beta+e_i}}{1+e^{f(Lev_i,\theta)+x_i'\beta+e_i}}$$

or

$$P_i = \frac{1}{1+e^{-(f(Lev_i,\theta)+x_i'\beta+e_i)}}$$

The partial derivative of P(takeover) with respect to leverage is:

$$\frac{\delta P_i}{\delta Lev_i} = (1+e^{-ARG})^{-2} \frac{\delta f(Lev_i,\theta)}{\delta Lev_i} e^{-ARG}$$

where

$$ARG_i = f(Lev_i,\theta) + x_i'\beta + \varepsilon_i$$

Because e raised to any power is nonnegative, the sign of the partial derivative of the probability of takeover with respect to leverage is determined by the sign of the partial derivative of $f(Lev_i,\theta)$ with respect to leverage.

When $f(Lev_i,\theta) = \theta Lev_i$, the sign of the partial derivative of the probability of takeover with respect to leverage is always of the same sign as θ, and therefore monotonic. When $f(Lev_i,\theta) = \theta_1 Lev_i + \theta_2 Lev_i^2$ then $df/dLev_i = \theta_1 + 2\theta_2 Lev_i$. Therefore, the sign of the partial derivative of the probability of takeover with respect to leverage depends on θ_1, θ_2, and Lev_i. This may imply a nonmonotonic relationship. In this study a nonmonotonic relationship is implied by the finding of $\theta_1 > 0$ and $\theta_2 < 0$. The probability of takeover is increasing in leverage where $Lev_i < (\theta_1/(2\theta_2))$, and decreasing where $Lev_i < (\theta_1/(2\theta_2))$.

BIOGRAPHICAL SKETCH

Matthew Thayer Billett received his high school diploma from Woodberry Forest School in Orange, Virginia in 1985. He attended Colgate University in Hamilton, New York where he received a Bachelor of Arts in mathematical economics in 1989. He went directly to the University of Florida where he earned his Ph.D. in Finance in December of 1993.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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December, 1993

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